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Pavel Ivanov photo

Monkfish tagging trip aboard gillnetter Gertrude H, with researcher Larry Alade.

Researchers, fishermen tag monkfish; probe north/south mixing rates

by Janice M. Plante

WOODS HOLE, MA – It takes a bit of skill to do surgery on a monkfish, especially at sea in the bitter cold.

But several researchers have mastered the art, making delicate incisions in the tail of each fish to surgically implant bullet-shaped data storage tags. They did it 150 times in 2009 aboard commercial fishing vessels and, as the new year opened, were prepping to head out to sea to do it again.

Newport, RI-based fisherman Ted Platz, the industry partner on three of the 2009 trips, said the teams now had the system down pat.

“We’ve figured out ways to get a lot of tags out in a short period of time,” he said.

Aboard Platz’s *Gertrude H*, researchers and fishermen worked together to tag 18 fish in January, 26 in July, and 54 in December, all in Southern New England, which is considered part of the “southern” area for monkfish management purposes.

Gillnetter Tim Caldwell was the industry partner for the project’s Gulf of Maine trips, carrying researchers aboard his *C. W. Griswold*. Together, they tagged six fish in October and 46 in November.

Tagging teams were hoping to make a third northern-area trip with Caldwell in late January as *Commercial Fisheries News* was going to press.

Finding a rhythm

By the third trip in December on Platz’s boat, everyone knew their roles. Platz and a crewman worked to pull burly monkfish from the net, while two, two-person teams carried out surgeries simultaneously.

“The trick for us was hauling the net really, really slow,” Platz said.

That took some getting used to. Commercial fishermen, after all, haul for a living, and slow is not the name of the game.

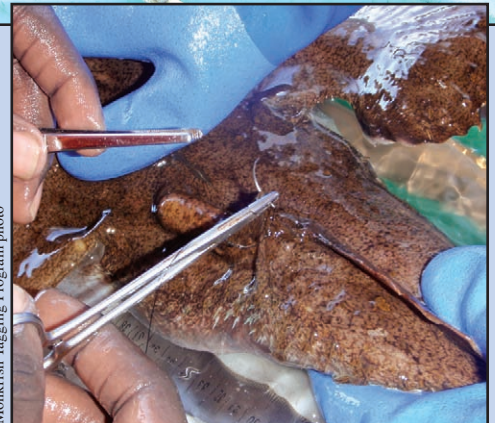
But slow hauling after a short, one-night soak produced live fish in prime condition – just the right candidates for tag implantation.

At first, the teams tried keeping monkfish in holding tanks on deck, lining up several fish in advance for tagging. But that didn’t work because the fish



Monkfish Tagging Program photo

Fishermen and researchers say that recovery of the information recorded by data storage tags (DST) is key to learning more about monkfish behavior. DSTs are surgically implanted at-sea, and the live monkfish are returned to the water. Above, NEFSC researcher Anne Richards and Curt Brown of GMRI are doing surgery on a monkfish during a tagging trip aboard the Gertrude H.



Monkfish Tagging Program photo

Researchers are able to complete the tag implant surgery and have the live monkfish back overboard in 5-7 minutes.

became stressed.

“They got slimy with mucus when we put them together,” said Platz, who worked with crewman Pavel Ivanov on the first tagging trip and Sergey Yuminov on the second two.

So, going against the grain, the gillnetters gave way to the slow-haul method, only supplying fish as needed, so that each of the sharp-toothed monks could have its own tank.

The teams soon fell into a rhythm. Industry partners handled the net, providing researchers with fish as needed, and researchers did the tag implantations. They injected each fish with oxytetracycline to mark its vertebrae, otoliths (ear bones), and dorsal spines for

aging studies that will be done after the fish are recaptured.

Altogether, it took between five and seven minutes to tag and inject each fish and gently put it back overboard.

Jon Grabowski of the Gulf of Maine Research Institute (GMRI) in Portland, ME, one of the tagging program's project leaders, said, "I watched those fish swim away. They looked very healthy."

Two tag types

The tagging work is part of a years-long collaboration between gillnetters and three of the region's most prominent research institutions – the Northeast Fisheries Science Center (NEFSC) in Woods Hole, GMRI, and the University of Massachusetts-Dartmouth's School for Marine Science and Technology (SMAST).

GMRI and fishermen have been tagging monkfish since 2007 with conventional T-bar tags – the ones that look like antennae sticking out of the fish. This work has been carried out through the Monkfish Research Set-Aside (RSA) Program, which is directly financed by industry. Fishermen collectively give up 500 monkfish days-at-sea per year to help fund research projects through the RSA program.

The T-bar tagging by itself has begun to provide important clues about monkfish movements, but this latest data storage tag (DST) work, also financed by the RSA program with additional support from the Northeast Consortium, goes even further.

"With the conventional T-bar tags, you know where the fish were released and where they were recaptured, but you have no idea where they have been in between," said Anne Richards of the science center, one of the project leaders for the DST work.

Many questions

With DSTs, commonly called archival tags, researchers can learn much more than the release-and-recapture points of a monkfish's travels. These remarkable tags additionally record time, temperature, and pressure, roughly every 10 minutes, for up to five years.

The pressure measurement is key because it can be used to estimate how deep a particular monkfish was swimming – all the way down to 1,500 meters, equivalent to 4,950 feet.

And that's what people really want to know: How deep do these monkfish go? How much time do they spend at depths beyond the reach of trawl surveys and



GMRI photo

I cannot emphasize enough how integrally involved the industry has been. They guide us to where the fish are. We use their vessels. We have been really fortunate to have so much support from industry.

—Jon Grabowski

commercial fishing activity? Do they travel from inshore to offshore and back again or visa versa? Do they move from south to north or the other way around? Where do the females go at certain times of the year when they seem to disappear? How deep do they go? Maybe they go very deep.

"These are big, overarching questions," said Grabowski. "We want to establish migratory patterns. We want to establish how much exchange there is between management areas. Is one area a source of monkfish and the other one a sink? Are there seasonal patterns of migration? Do they vary from the Gulf of Maine to Southern New England to the Mid-Atlantic Bight?"

Grabowski believes that finding answers to these questions is critically important to the commercial fishery.

"It's a very valuable fish species," he said. "It's important that we get it right."

Keep an eye out

So many questions and so much hope for answers, all contained in tiny canisters sutured just under the surface of the tail-skin on 16"-to-20"-long monkfish.

The tags leave a noticeable bulge, an obvious clue that something is different about the fish.

"It looks like someone's thumb was sewn in," said Platz. "It's pretty hard to miss."

But fearing that busy fishermen might pass by what could be mistaken for a large growth, researchers also attached two, bright pink T-bar tags along the midridge area of the tail. And those pink antennae are practically impossible to overlook.

Furthermore, researchers are hoping that the high reward for returning a DST-

Monkfish tagging: who, what, where, why at a glance

● **WHO:** Commercial fishermen and researchers from the Northeast Fisheries Science Center, the Gulf of Maine Research Institute (GMRI), and the University of Massachusetts-Dartmouth School for Marine Science and Technology (SMAST) are all involved in the collaborative tagging program.

● **WHAT:** Two types of tags are being used. Data storage tags, also called archival tags, look like bullets implanted just under the tail skin. T-bar tags stick out of the tail like colored antennae.

● **WHERE:** So far, tagging has taken place in the Gulf of Maine and Southern New England, and plans are in the works to expand tagging into the Mid-Atlantic and offshore areas. The Northeast Consortium and the industry-financed Monkfish Research Set-Aside Program have paid for the work with overhead and staff/research support from GMRI, SMAST, and the science center.

● **WHY:** The purpose of this enormous effort is to learn more about monkfish migration patterns, monkfish behavior, and the level of intermixing between the northern and southern management areas. Additional research, which is being conducted simultaneously on recaptured fish, is focusing on monkfish aging. /cfn/

tagged monkfish – \$500 per fish – will entice fishermen to keep a keen eye on their catches.

DSTs expensive

Getting data storage tags back from recaptured *whole* monkfish is absolutely crucial to the success of the project, according to every researcher involved.

These tags do not transmit information to satellites like some ultra-high-end archival tags. Instead, they serve as time capsules, storing data for downloading onto a computer after the fish is recaptured.

The tags are wildly expensive, which has limited the number of DSTs the tagging teams can put in the water. Once this current round of tagging is complete, the teams will have implanted a total of 190 high-tech Star-Oddi DST centi-TD loggers at \$360 a pop.

They also have on hand an additional 40 or so lower-quality DSTs, courtesy of SMAST, for external attachment. These 40 won't provide quite as much information and probably won't record as long as the Star-Oddi tags, but it's another tagging opportunity that everyone welcomes.

"We're using every opportunity we can to get as many tags out there as possible," said Richards.

And that includes more T-bar tagging.

Practice makes perfect

Given that the archival tags are so valuable, researchers wanted to be sure they were right on the money with tag placement and fish survival rates.

So, before any of the at-sea tagging got underway, researchers spent a year honing their surgical skills in the lab with the help of a separate Northeast Consortium grant.

And now, with four trained "surgeons" and a fairly slick tagging system, the tagging teams are ready to keep going as long as they can buy more tags and receive funding for future projects.

"We can learn so much about monkfish behavior from these tags," said Richards.

She has plenty of questions of her own.

"Where do these fish spawn?" Richards wondered. "At the surface? At the edge of the continental shelf? Could they be riding currents to migrate? They're hydrodynamically designed. Their pectoral fins are like wings, and there

have been sightings of monkfish at the surface. Are these fish going to Canada?"

While the information contained in those tiny canister-like DSTs probably won't answer all of those questions definitively, the stored data will provide important pieces of a very big puzzle.

T-bar tag results

Promising as it all is, the limiting factor with these remarkable data-rich archival tags is their cost; \$360 apiece is a lot of money.

In contrast, conventional T-bar tags run less than a dollar each.

"The trade off is you can put out a lot of T-bar tags really cheap," said GMRI's Graham Sherwood.

In 2007 alone, GMRI and fishermen tagged 2,770 fish during the fall. It was the very first monkfish tagging study in the Northeast.

Of the 1,006 fish tagged in the north, 1.7% were recaptured, and of the 1,764 tagged in the south, 3.9% were recaptured. Only fish that were "at liberty" for more than 30 days after being released were counted as "recaptures" in the study, and most of the recaptures occurred



Pavel Ivanov photo

Three monkfish tagging trips were made aboard Ted Platz's gillnetter *Gertrude H.* Pictured here during the January 2009 trip, from left, Platz and researchers Crista Bank of SMAST and Larry Alade of the NEFSC.



Monkfish Tagging Program photo

Gillnetter Tim Caldwell is the industry partner for the tagging project's Gulf of Maine trips, carrying researchers aboard his *C. W. Griswold*. Caldwell is pictured above during a 2007 trip when monkfish were tagged with conventional T-bar tags, work carried out through the Monkfish Research Set-Aside Program.

within 10 months of release.

The results were intriguing. Contrary to popular thinking, 9.1% of the fish tagged in the northern area were estimated to have moved to the south (see chart, below). However, none of the fish tagged in the south had moved north.

Therefore, the study concluded that mixing rates were “low and unidirectional,” and average movement was to the southwest.

But no one was putting undue weight on these results, especially since researchers strongly suspect that at least some monkfish move from south to north.

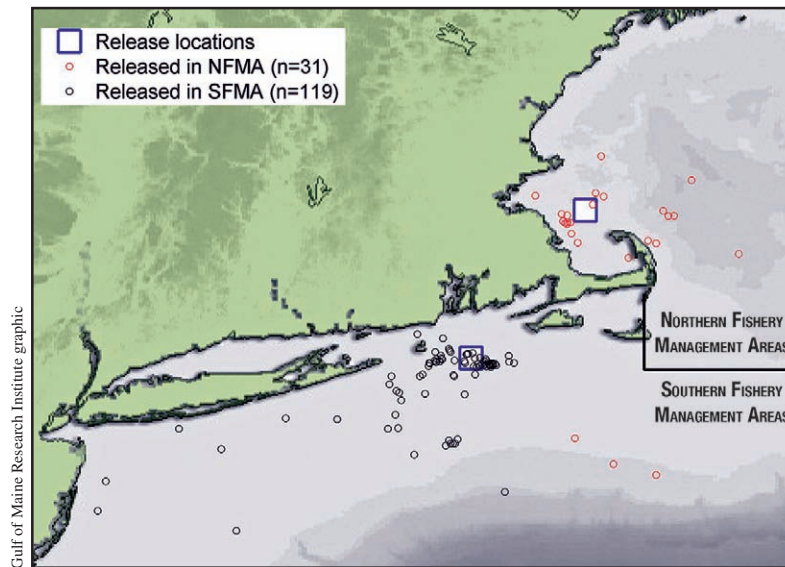
“The only data we have so far is from those 2007 fish,” said Sherwood, who headed up the project. “It’s a very preliminary snapshot of what’s going on. No

juveniles were tagged, and they may be the ones that are moving north. We need to tag in other seasons and in other areas. Plus, our return rate for the north was very low.”

The study did show that monkfish have the potential to travel great distances. According to Sherwood, one monkfish tagged and released off Boston was recaptured off New Jersey.

More in 2010

During 2010, GMRI hopes to get an



In addition to showing the line marking the northern and southern fishery management areas, the chart shows monkfish tag release/recapture locations. Note recaptured fish represented by red circles were tagged and released in the northern area. Black circles are for recaptured fish released in the southern area.

additional 5,000 T-bar tags in the water, this time further south into the Mid-Atlantic and further offshore, as well as during the spring instead of the fall.

And, researchers also intend to train fishermen to do the tagging themselves. They’ll meet with participating industry members to ensure they understand tagging methods and what’s needed for data collection.

Yet even before any further training, researchers expressed full confidence that fishermen can take the lead on the at-sea

T-bar work. Not only will this save valuable time and resources, but it will allow the tags to be more widely distributed.

Grabowski, a project leader for the 2010 T-bar work, said, “The fishermen involved in this are very interested in the science. They told us, ‘You know, we can do these tags ourselves. You guys don’t have to be on the boat.’”

All of the researchers involved in the tagging project expressed sincere appreciation for the partnerships they have developed with fishermen.

“I cannot emphasize enough how integrally involved the industry has been in all of this,” Grabowski said. “They guide us to where the fish

are. We use their vessels. We have been really fortunate to have so much support from industry. That kind of buy-in is invaluable.”

From gillnetter Ted Platz’s perspective, the work is worth the effort.

“It’s what the fishery needs,” he said. “We need to know about the mixing rates from north to south and how these fish move. I think there are a lot of misconceptions about the lives these monkfish lead. We need to do what it takes to get better science.” ■



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Read. Respected. Real.

Find a tagged monk? Save *whole* fish fresh, not frozen

WOODS HOLE, MA – Anyone lucky enough to haul up a monkfish outfitted with a valuable data storage tag (DST) can claim a \$500 cash reward simply by saving the fish – the whole fish – and shipping it to researchers or arranging for a pick-up.

The bullet-shaped, canister-like tags are surgically implanted in the tail of the fish and form a significant bump under the skin. And, to further grab people's attention, two pink T-bar tags, which look like bright antennae, stick out around the midridge area of the tail.

Researchers are asking fishermen to save the *entire* fish, not just the tail, and, if at all possible, to keep the fish on ice in "fresh" condition. Freezing is a backup if necessary, but it's nowhere near as good as fresh.

"It's really important that we get the whole fish back," said Anne Richards of the Northeast Fisheries Science Center, one of the project leaders for the DST tagging work.

"It's way better to get a fresh fish than a frozen one, but frozen is better than rotten," she said.

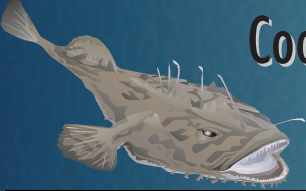
The whole fish is important because researchers at the science center, the Gulf of Maine Research Institute (GMRI), and the University of Massachusetts-Dartmouth School for Marine Science and Technology are carrying out a variety of different studies with numerous parts of the fish.

Among other things, researchers want to look at each fish's gender, reproductive state, length and weight at recapture, stomach content, vertebrae, dorsal spines, and otoliths.

"We're taking every kind of sample possible for genetic studies, feeding and aging studies, reproductive biology studies, and microchemical analyses to tell us where these fish have been," said Richards.

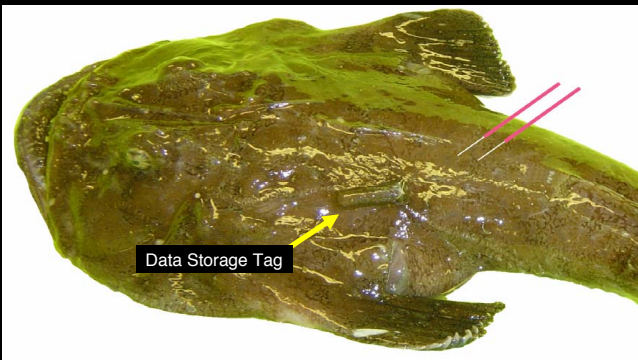
Researchers considered various options for tag placement but settled on the tail.

"That way, if the tag is missed on the boat and the tail goes into the market, it might be caught at the dealer or consumer level, or even during processing," Richards said.



Cooperative Monkfish Tagging Study

Have you caught a monkfish with pink tags?
If so, you are eligible for a...



\$500 REWARD



These fish have been implanted with electronic data storage tags to help us investigate large-scale monkfish movements and behaviors.

To Claim Your Reward:
 You must **SAVE THE ENTIRE FISH*** and report capture date and location.

To report a tagged fish or for more information:
 visit: <http://www.gmri.org/tagging> or
<http://www.nefsc.noaa.gov/read/popdy/TagReporting/TagReporting.htm>
 email: monkfishtagging@gmri.org (subject monkfish)
 call toll-free: 1-866-447-2111

*Please store on ice or freeze if necessary.

Contact us for instructions on where to send the fish and to receive your reward.

Administered by the Gulf of Maine Research Institute • 350 Commercial Street • Portland, ME 04101

What to do

Any fisherman who catches one of these DST-tagged monkfish should record the location of the recapture, save the fish on ice, and, as soon as possible, call the toll-free number to alert researchers to the important find. They'll tell you what to do from there.

The number is 1-866-447-2111.

The electronic tags are expensive to buy, costing \$360 each. But each one can log up to five years worth of priceless data.

"That's why we're trying our best to get high return rates," said GMRI's Graham Sherwood, who's involved in the project.

For more information about tag returns and the tagging program in general, visit the GMRI web site at www.gmri.org/tagging or the science center web site at www.nefsc.noaa.gov/read/popdy/TagReporting/TagReporting.htm.

Janice M. Plante

Monkfish aging study may alter old thinking

NEW BEDFORD, MA – Like many other fish species, monkfish can be aged by reading the number of “rings” on certain bony body parts such as otoliths, vertebrae, and dorsal spines. It’s like counting the circles on a slab of tree trunk. Three rings means the fish is three years old. Ten rings means it’s 10 years old.

Or does it?

Scientists are beginning to question whether this long-accepted aging technique is completely suitable for monkfish, especially the older ones.

“We could be underestimating age. We’re not sure if a ring is laid down every year when growth slows down,” said Crista Bank, a technician at the University of Massachusetts-Dartmouth School for Marine Science and Technology (SMAST) who is also working on a master’s thesis about the subject.

Yet knowing the age of monkfish is key to understanding their basic biology. So that’s why researchers have embarked on a new series of studies to get to the root of the matter.

“We want to validate that the aging method is accurate, which will give us more confidence in our stock assessments,” said Bank.

While the primary purpose of Bank’s monkfish work at SMAST is to determine whether the current aging methodology is producing good results, she also is investigating whether one particular aging tool is preferable over another.

Is it better to count rings on otoliths – those tiny, calcified inner ear bones – or on vertebrae, which distinctly show rings without even being sliced? Or what about the first dorsal spine – the one with the

In addition to surgically implanting data storage tags into monkfish, researchers also inject the fish with oxytetracycline. The antibiotic “marks” the fish for aging studies and may help reduce the chance of infection at the tag incision.

Monkfish Tagging Program photo



Researchers, working aboard commercial fishing vessels, have been surgically implanting data storage tags into monkfish tails and then injecting the fish with oxytetracycline.

The tagging project is designed to produce more information about monkfish migration patterns and north/south mixing rates, but the oxytetracycline injections are part of the aging studies.

The oxytetracycline “marks” the fish. It works by leaving a light glow or stain on the specific ring that was being laid down at the time the fish was caught, tagged, and injected.

Then, when the fish is recaptured, researchers will be able to look for the marked

ring with ultraviolet light, which will help them determine how much growth occurred between tagging and recapture, assuming the fish isn’t recaptured before it has time to grow.

Crista Bank also is keeping live monkfish in holding tanks at SMAST.

“Growth in the lab won’t be like actual growth in the wild, but we should be able to see seasonal growth patterns,” she said. “This also will help us confirm whether the oxytetracycline method is working.”

Bank participated in all but one of the 2009 tagging trips and is one of four researchers who have mastered the surgical procedure used to implant the high-tech electronic data storage tags into monkfish tails. She also has taught other researchers to do oxytetracycline injections so the work can continue even when she’s not onboard.

Oxytetracycline is an antibiotic. Anne Richards of the Northeast Fisheries Science Center, one of the project leaders in the monkfish tagging program, said using the antibiotic for aging studies might have an ancillary benefit following tag surgery.

“fishing lure” dangling from it? That’s what some European scientists use to age monkfish.

Graham Sherwood of the Gulf of Maine Research Institute (GMRI) has been deeply involved in the monkfish tagging program and its related studies. He emphasized the importance of all of the various aging work.

“There’s a real difficulty in aging monkfish,” he said. “We really need to know how long they live.”

Oxytetracycline

Some of the aging work is being carried out during monkfish tagging trips.

There’s a real difficulty in aging monkfish, and we really need to know how long they live.

—Graham Sherwood



"It should help with healing by reducing the chance of infection at the tag site," she said.

Microchemical work

In another phase of the aging work, researchers plan to save otoliths from recaptured monkfish for future microchemical analyses that may help them better interpret growth rings.

The people involved hope to age fish chemically by looking at the ups and downs of certain microchemical components in the otoliths, such as with the element strontium. Researchers may be able to track seasonal variations in temperature, for example, by looking at differences in strontium concentrations.

It's complicated and highly technical work for sure, but it has the potential to provide amazing results.

Graham Sherwood said GMRI researchers ran a single otolith through the process at Memorial University in St. John's, Newfoundland.

"We thought it was an eight-year-old monkfish," he said. "But after the analysis, it looked like it might have been more like 13 years old."

Thanks to industry

The aging studies will be years in the making and won't produce any immediate results, but fishermen are supportive of the effort, knowing that better aging information will lead to better stock assessments, which then will lead to better management.

With this in mind, industry has been working hand-in-hand with researchers, taking them to sea when needed and supplying them with fish.

Bank, who was readying to meet a fisherman at the dock one Friday night in mid-January to pick up yet another live monkfish for her laboratory holding tanks, expressed deep appreciation for industry's support.

"Without them, we couldn't do any of this," she said. "We rely on their help."

Janice M. Plante



Monkfish Tagging Program photo

Crista Bank, an SMAST technician, is working on a study of current monkfish aging methodology.



Pavel Ivanov photo

Above, NEFSC's Larry Alade with the T-bar tags. GMRI hopes to get an additional 5,000 T-bar tags in monkfish in 2010. Researchers intend to train fishermen to do the tagging, training them on tagging methods and what's needed for data collection.

Types of Tags

Fishermen are asked to save the entire fish, if they land a monkfish that has been implanted with a data storage tag, see below. The canister-like tags create a visual bump under the skin in the tail of the fish. The fish have also been marked with two pink T-bar tags, which stick out around the midridge area of the tail.



Monkfish Tagging Program photo